Benefits Determination

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Overview

- Review Of ARB Staff Report Analysis Of Real World Benefits
- Update Of ARB Analysis Per CEC Refiner Survey Of 1998 In-Use Fuel Properties
- WSPA Approach To Projection Of Phase 3 In-Use Fuel

Analysis of Benefits Preservation

- ARB Cites SB989 As Controlling

  "Maintain or improve upon emissions and air quality benefits achieved by California Phase 2 Reformulated Gasoline in California as of January 1, 1999, including emission reductions for all pollutants, including precursors, identified in the State Implementation Plan for ozone, and emission reductions in potency-weighted air toxics compounds."

- Need To Compare 1998 In-Use Fuel With Phase 3 In-Use Fuel
- For 1998, Know:
  - Flat Limits
  - Average Predictive Model Alternative Litmus (ARB Analysis)
  - And Average In-Use Fuel Properties (ARB And CEC Analyses)
- For Phase 3, Know:
  - Proposed Phase 3 Flat Limits
- Key Issue: How To Best Project Phase 3 In-Use Fuel

Staff Report Estimation Of Phase 3 In-Use Fuel

Assume:

- CARB Phase 3 Proposal:
  - Sulfur 20 ppm
  - Benzene 0.8 vol%
  - RVP 6.9 psi
- Current compliance margins will remain

	ARB Proposal	Proposal Less Compliance Margins (1)	Projected In-Use Fuel (2)
RVP	**6.90**	**6.58**	**6.70**
T50	**211**	**203**	**203**
T90	**305**	**298**	**298**
Aromatics	**25.0**	**22.6**	**22.0**
Olefins	**6.0**	**4.5**	**4.0**
Oxygen	**2.0**	**2.0**	**2.0**
Sulfur	**20**	**17**	**15**
Benzene	**0.80**	**0.61**	**0.40**

(1) Compliance Margins From Table II-4
(2) Table V-3

Staff Report Analysis Of ARB Proposal

	Phase 2		Phase 3	
	Flat Limits	Average Fuel (1)	Flat Limits	Average Fuel
RVP	7.00	6.70	6.90	6.70
T_{50}	210	197	211	203
T_{90}	300	310	305	298
Aromatics	25.0	22.4	25.0	22.0
Olefins	6.0	5.8	6.0	4.0
Oxygen	2.0	2.0	2.0	2.0
Sulfur	40	25	20	15
Benzene	1.00	0.60	0.80	0.40

Model Predictions:	Beta 2 Model Relative To CARB Phase 3 Proposal (2)	Beta 2 Model Relative To CARB Phase 3 Proposal (2)	Net Environmental Benefits:
NOX	0.3	-2.0	-2.3
THC	-4.5	-4.6	-0.1
PWT	-8.0	-15.2	-7.2

(1) ARB Estimate, Table II-5

(2) Evaporative HC Converted To Mass Basis, Table V-4

1998 In-Use Fuel

- ARB Analysis:
  - Complete Data Base Of PM Alternative Specifications (>2000)
  - Smaller Data Base Of Test Data (64 Samples)
  - Used Subset Of Matched Specification and Test Data To Determine Compliance Margins
  - Applied Compliance Margins To Average PM Alternative Specifications To Get Average Fuel
- CEC Survey:
  - Refiners Reported Lab Test Results
  - CEC Compiled Data

Staff Report Analysis Of ARB Proposal, Updated Per CEC Data

	Phase 2		Phase 3	
	Flat Limits	Average Fuel (1)	Flat Limits	Average Fuel
RVP	7.00	6.78	6.90	6.70
T_{50}	210	201	211	203
T_{90}	300	310	305	298
Aromatics	25.0	23.4	25.0	22.0
Olefins	6.0	4.5	6.0	4.0
Oxygen	2.0	2.0	2.0	2.0
Sulfur	40	22	20	15
Benzene	1.00	0.59	0.80	0.40

Model Predictions:	Beta 2 Model Relative To CARB Phase 3 Proposal (2)	Beta 2 Model Relative To CARB Phase 3 Proposal (2)	Net Environmental Benefits:
NOX	-0.6	-2.0	-1.4
THC	-2.9	-4.6	-1.7
PWT	-8.1	-15.2	-7.1

(1) CEC Survey of California Refiners

(2) Evaporative HC Converted To Mass Basis

Projection Of Phase 3 Fuel Properties

- ARB's Analysis Demonstrated That There Are Two Components To The Difference Between The Flat Limits And The In-Use Fuel:
  - Use Of The Predictive Model To Develop Alternative Specifications
  - Property Compliance Margins
- Projection Of The Properties Of Phase 3 Fuel Must Reflect The Realities Of Producing Fuel As Demonstrated In Phase 2

Components

- Use Of The Predictive Model To Develop Alternative Specifications
  - Difficult To “Zero-Out” THC And NOx Simultaneously
  - Non-Linearities Produce Differences Between Average Emissions And Emissions Predicted From Average Fuel Properties
- Property Compliance Margins
  - Applied to PM Alternative Specifications, As Per ARB’s Analysis

How To Determine The Corresponding In-Use Fuel For A Set Of Flat Limits

Proposed Flat Limits

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Subtract Historical PM Usage Artifacts

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Projected Average Certification Target

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Subtract Compliance Margins (Evaluated From CEC Survey And CARB Certification Data)

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Predicted Average Future In-Use Fuel Specifications

Phase 2 Compliance

	Flat Limits	Average Flat Limit Specs.	Average Fuel	Compliance Margins
RVP	7.00	7.00	6.78	0.22
T_{50}	210	204	201	3
T_{90}	300	317	310	7
Aromatics	25.0	25.3	23.4	1.9
Olefins	6.0	6.8	4.5	2.3
Oxygen	2.0	2.0	2.0	
Sulfur	40	27	22	5
Benzene	1.00	0.77	0.59	0.18

Model Predictions:	Phase 2 Model Relative To Phase 2 Flat Limits
NOX	-0.37
THC	-1.05
PWT	-0.69

Phase 3 Property Expectations vs. Flat Limits

- Properties Expected To Decrease:
  - RVP
  - Sulfur
  - Benzene
- Properties Expected To Increase:
  - T_{50}, T_{90}
  - Aromatics
  - Olefins

Analysis Of ARB Proposal

	Phase 2			Phase 3		
	Flat Limits	Average Flat Limit Specs.	Average Fuel	Flat Limits	Average Flat Limit Specs.	Average Fuel
RVP	7.00	7.00	6.78	6.90	6.80	6.58
T_{50}	210	204	201	211	205	202
T_{90}	300	317	310	305	318	311
Aromatics	25.0	25.3	23.4	25.0	27.0	25.1
Olefins	6.0	6.8	4.5	6.0	7.0	4.7
Oxygen	2.0	2.0	2.0	2.0	2.0	2.0
Sulfur	40	27	22	20	15	10
Benzene	1.00	0.77	0.59	0.80	0.61	0.43

Model Predictions:	Phase 2 Model Relative To Phase 2 Flat Limits	Beta 2 Model Relative To CARB Phase 3 Proposal (1)	Beta 2 Model Relative To CARB Phase 3 Proposal	Beta 2 Model Relative To CARB Phase 3 Proposal (1)	Net Environmental Benefits:
NOX	-0.37	-0.58	-0.30	-2.24	-1.66
THC	-1.05	-2.88	-1.05	-5.22	-2.34
PWT	-0.69	-8.06	-0.63	-10.17	-2.11

(1) Evaporative HC Converted To Mass Basis

Differences Between ARB Staff Report And WSPA Analysis

- New 1998 Fuel Properties (CEC)
- Use Of Engineering Judgement To Determine Future PM Alternative Specs.
  - Maintain Margin Due To Model Use
  - Reduced RVP To Gain Credit Using Evaporative Model

Conclusions

- Staff Report:
  - Understates THC Benefits
  - Overstates NOx Benefits
  - Overstates PWT Benefits
- ARB Proposed Specifications Produce Emissions Reductions Well Beyond Preservation Of Real World Benefits